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SECOND SERIES VOL. 10, No. 6

# BULLETIN

## OF

# THE NEW YORK ACADEMY OF MEDICINE

INCORPORATED 1851

JUNE, 1934

PUBLISHED MONTHLY BY

THE NEW YORK ACADEMY OF MEDICINE

2 East 103 Street

New York, N. Y.

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VOL. 10 JUNE, 1934 No. 6

# ANNUAL GRADUATE FORTNIGHT
# "DISORDERS OF METABOLISM"
## October 23 to November 3, 1933

## *Round Table Conference on Diabetes Mellitus**

### DIETARY TRENDS

ROLLIN T. WOODYATT
Chicago

The history of diabetes is marked by the recurrence of certain ideas which rise, decline and disappear, only to make a new appearance and go through a similar cycle again in an altered form, and a new generation. This is notably true of trends in diet. Certain conceptions recur more often and tend to stay with us longer and longer until we come to regard them as permanent.

*Calorie Magnitude of the Diet.* The conception that overnutrition is detrimental to health in the presence or absence of diabetes, and in its presence, specifically so, appears to be true. An extension of this idea is to the effect that in diabetes some degree of undernutrition favors the preservation of natural carbohydrate tolerance or of its partial rebuilding or restoration in cases in which restoration is possible. When tolerance has sunk to the vanishing point and remained there in spite of all efforts to build it up, for a long enough time, then, until future discoveries change the picture, we must consider the natural tolerance dead, burnt out or beyond recall. When this stage is reached, there is no longer hope

*Delivered October 30, 1933 before the joint meeting of The New York Academy of Medicine and the Medical Society of the County of New York.

of preserving or rebuilding natural tolerance by any present day method. However, even in this situation it is held that undernutrition may increase the effectiveness of the unit of insulin, permit one to use a smaller dose, and make the management generally smoother and safer. Joslin recommends as a general rule that, in the case of a diabetic patient of a given age, height and sex, the diet should be restricted enough to keep the body weight 10 per cent below the average for normal subjects of the same age, height and sex, as shown on standard statistical tables. Probably if this rule were followed in every case the advantages gained would outweigh occasional disadvantages. There are exceptions to every rule. Still, all things considered, most writers agree that overnutrition is undesirable and that it is better to keep a patient spare and under—rather than overnourished. Accordingly, the calorie magnitude of the diet should be adjusted to keep the body weight at the level desired.

*Protein Limitation.* Another conception that has returned persistently through the years and has come to be looked on as fairly established, is that an excess of protein is undesirable. Here again opinions will vary for some time to come as to the desirable limits of protein restriction. For adults, an allowance of somewhere between 0.75 and 1.25 gm. per kilo per day might meet the approval of most modern writers. For growing children a larger allowance is recommended by pediatricians, *i. e.*, 2.0 to 2.5 gm. per kilo.

*Carbohydrate and Fat.* Having fixed the number of total calories and the quantity of protein (which determines the number of protein calories) there will be a calorie remainder to be supplied by carbohydrate and fat, and whatever quantity we use of one will determine the quantity of the other, for if the total non-protein calories were 1500 and if we used 150 gm. of carbohydrate, producing 600 calories, we would have to use 100 gm. of fat to make up the 900 calorie balance. The question then arises as to how much of each may best be employed—or stating it more simply, how much of either.

In some of the older rigid diets or diets of the types associated with the names of Newburgh and Marsh or Petrén of Sweden, the carbohydrate has been reduced to a minimum. In some of the diets of Newburgh and Marsh it has represented but 5 to 10 per cent of the non-protein calories, the remainder being supplied by fat, and this implies that the fat outweighs the carbohydrate roughly 8 or 4 to 1. However, the total quantity of fat or carbohydrate depends not merely on the relative proportions but also on the total magnitude of the diet. With a diet containing 1700 non-protein calories the above ratios would indicate 20 to 40 gm. carbohydrate and 170 to 180 gm. fat, whereas, with only 1000 non-protein calories, they would indicate not over 105 gm. fat. All such diets are sometimes referred to as "high fat" diets without regard for magnitudes but only the larger ones are absolutely high in fat. The smaller are actually low in fat. But they all have in common *low carbohydrate.*

In contrast with the above are diets containing larger quantities of carbohydrate, and all other factors remaining the same, correspondingly smaller amounts of fat. They are referred to by some as "high carbohydrate" diets or by others as "low fat" diets—depending on the author's idea as to whether elevation of the carbohydrate or depression of the fat is the more important consideration. The employment of diets of this description is by no means a recent innovation. Allen states that according to Stokvis milk was recommended for diabetes by almost all writers in the 18th century, and that Richardson credits a "Dr. Smart of Edinburgh" with priority in the use of a formal "milk cure." In any event, in 1874 Donkin published a paper on diabetes mellitus successfully treated with skimmed milk, which became widely known and started the movement. He gave diets of low calorie value consisting almost entirely of skimmed milk. One hundred grams of skimmed milk may contain 5 gm. carbohydrate, 3 gm. protein, 0.3 gm. fat, and about 35 calories. To provide, let us say 1750 calories, the quantity of skimmed milk required would be 5 liters. This would contain 250 gm. carbohy-

drate, 150 gm. protein and 15 gm. fat (C:F ratio 17:1). A whole milk diet of the same calorie value would contain approximately 125 gm. carbohydrate, 75 gm. protein and 100 gm. fat (C:F ratio 1.25:1). So milk diets may have compositions corresponding closely with those of modern "high carbohydrate" diets.

Following Donkin, many writers employed his methods with good results, and "milk cures" in one form and another remained in use for a long time. They have been recommended as useful in some situations by such noted authorities as Naunyn (1896), and von Noorden (1898 to 1910), and were reindorsed by Winternitz and Strasser (1899). Again, as late as 1915 their beneficial effects were pointed out by Williamson and by La Farge, the latter believing that the lactose in milk was particularly well tolerated, and that it increased the tolerance for other carbohydrates. But milk cures never enjoyed a vogue in the United States, although they were doubtless tried by individuals.

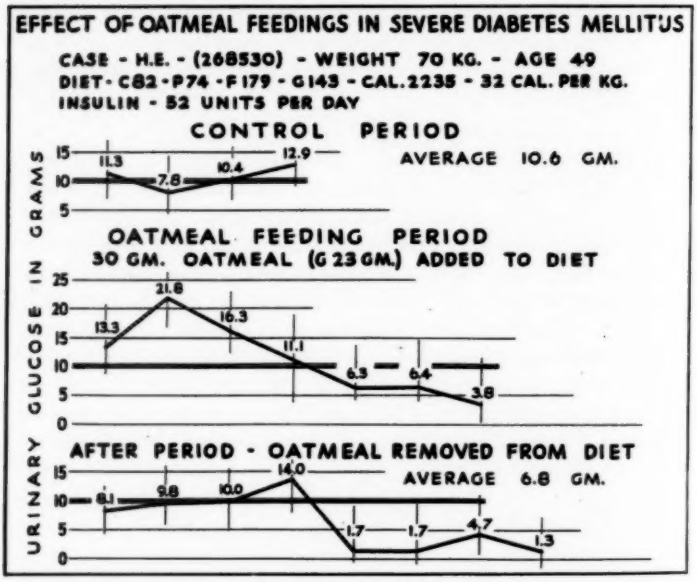
The von Düring vegetable cure first described in 1868, consisted in the administration of rice or other cereals, some bread, fruits, milk, wine and a rather liberal allowance of meat. The von Düring diets were low in calories, high in carbohydrate, moderate in protein and low in fat. Their composition can not be stated exactly. Beneficial results were often obtained by von Düring and others who followed his methods.

The Mossé "potato cure" so called, first described in 1898, involved the use of liberal or even enormous quantities of potato. This method enjoyed a vogue in France. The alleged benefits were attributed to specific properties of the potato. We may allow for gross exaggerations of the percentage of cases in which beneficial results were really obtained by the Mossé method, and still understand how a diet composed more or less exclusively of potatoes may be high in carbohydrate, low in protein, low in fat, and easily low in total calories. More than 2 kilos of boiled potatoes would be required to provide 1800 calories. In the light of present day knowledge there is little

doubt that the reputation of the Mossé potato cure rested on the occasional observation of the same type of results as those observed with the Donkin or Düring "cures."

The "oatmeal or oat cure" as described by von Noorden (Zuckerkrankheit, 5th ed., p. 312, 1910) consisted of 250 gm. oatmeal, 200 to 300 gm. butter, and 100 gm. of vegetable protein or 5 to 8 eggs. It might therefore, contain C.161, P.140, F.185 to 270 gm. and yield in round numbers 2900 to 3700 calories, depending on the quantity of butter employed. With the eggs in place of the plant albumin, the protein would be 30 to 50 gm. less, and the fat 30 to 50 gm. higher, so that the fat might rise to the high extreme of 320 gm. Such a ration would have to be described as a high calorie, high carbohydrate, high fat diet, with moderate protein (70 to 140 gm.). The fat exceeds the carbohydrate sometimes as much as 2 to 1. Concerning the "oat cure," von Noorden says, "It is of extraordinary practical significance; the theory of its action however, presents a most difficult problem. I discovered its significance quite accidentally. Some patients in my clinic were troubled with severe disorders of the stomach and bowel. I therefore gave them oatmeal gruel. Remarkably enough, the glycosuria did not increase, but became much less than it had been before on the most rigid diet. This became the starting point for further researches which were continued most carefully for two years before I ventured to publish the paradoxical facts." *Several days on a rigid diet and 1 or 2 days on a low vegetable diet usually preceded the oatmeal diet,* which was then given for 3 or 4 days and followed by 1 or 2 vegetable days. Continuing the quotation—"In suitable favorable cases it is observed that in the beginning of the oat cure the glycosuria frequently rises somewhat; but after several days it sinks decidedly, and with it or even to a relatively greater degree, the ketonuria sinks. Often even during the first oat period one obtains entirely sugar free urine; if this is not the case, one may still count on it with fair certainty during the following vegetable days." "Whoever considers the tables without prejudice must admit that results were

obtained with respect to glycosuria and ketonuria that one would not have thought were possible before. *Unfortunately, there are relatively few cases in which the results are so surprisingly favorable;* in other cases the results were entirely absent or only partial." In 1910 von Noorden believed that the favorable results obtained with other cures—Donkin's von Düring's, Mossé's, etc., were due to the use of simple rations containing but one kind of carbohydrate, and that the oat cure was similar in this respect, but that it was superior to others, and owed its superiority to specific properties of oats.




The oatmeal "cure" led to studies of various cereals and cereal diets by Falta, Porges, Salomon and others. Porges discarded von Noorden's belief in the specificity of oats, but held to the view that it was necessary to use but a single cereal or carbohydrate. However, Falta effectually dispelled this misconception by obtaining the same results with various cereals and cereal mixtures. He stress-

ed the importance of *protein restriction* in kind and quantity. In 1911 Klemperer appears to have shown that results quite analogous to those observed in the course of an oat cure could be produced by the use of glucose alone, and it is remarkable how many years had elapsed, and how much work had been done with complicated mixtures and intricate theories before pure sugars were experimentally tested. The literature on this subject continued up to the time of the war. It was almost entirely European.

The following years saw a rapid development of research in this country, especially in the field of metabolism and diabetes, but interest ran in other channels. There was an inclination toward skepticism concerning the phenomena said to occur in the course of "cures" and to think that there was nothing mysterious about them. I erred for one in averring at one time that their reputation rested on faulty measurements of the glucose supply, in a paragraph quoted by Graham Lusk. Allen said also in 1919—"The rationale of the carbohydrate 'cures' appeared mysterious when diabetes was regarded as a deficiency of carbohydrate assimilation, but becomes clear with the understanding of diabetes as a general disorder of the metabolism." He felt at that time that the preliminary undernutrition and limitation of fat and protein accounted for all the alleged results.

Before proceeding, let us look at a chart (see Figure) which shows the phenomenon under discussion. A male patient with severe diabetes who had been for nine years on insulin treatment and had served repeatedly in feeding experiments, was forty-nine years old, 5 ft. 9 in. tall, and weighed 154 lbs. or 70 kg. The patient was not confined to bed but did light and standardized physical work. The diet contained carbohydrate 82 gm., protein 74 gm., fat 179 gm., calories 2235 (32 cal. per kg.). The insulin was adjusted to allow the excretion of an easily measurable quantity of sugar. The dose of insulin was 52 units. He was kept on this diet and insulin dose until for 10 days the sugar excretion had varied not more than 3 gm. above or below a mean of 10. Then, as a simple superposition on his

regular diet, he was given 30 gm. oatmeal daily for 7 days, in which all other factors remained the same. This quantity of oatmeal contains 113 calories and 23 gm. of glucose equivalents. The oatmeal period was followed by an after period in which conditions were the same as before. It will be seen that the sugar excretion rose temporarily and then fell below the original level, as described by von Noorden during an oat cure. After withdrawal of the oatmeal the glycosuria returned to its former level for 3 days, then disappeared except for a trace.* It may be noted that the patient was of nearly average weight for his height and not undernourished during the experiment. The addition of the oatmeal increased the calories by 113. The diet was high in fat throughout and of a type that the patient had used for years. The effect would have to be ascribed simply to the *addition* of the cereal or, as it is possibly safe to say, the simple *addition of carbohydrate.*

At the end of the experiment the patient was apparently utilizing (burning, storing or both) 32 gm. more glucose than he had been before, although the insulin dosage remained the same. If, as Klemperer held, the same type of result may be obtained with feedings of glucose alone, the effect would seem to be that of the *carbohydrate.* But during the fore period there was at all times an excess of sugar in the body, and we might wonder why this was less available to the body than administered sugar. Although several hypotheses have been advanced to explain the phenomenon, it still presents an interesting problem for further investigation.

Now, resuming the narrative, after the war dietary trends in this country were generally toward low calorie, low protein diets in which the total quantity of fat was moderate, but usually higher than the carbohydrate. Meanwhile, Falta, Porges and others in Europe continued the use of cereal diets. With the advent of insulin in 1921,

*By the Folin-Berglund method of sugar determination employed the fractions to the right of the decimal are within normal limits.

American writers still adhered to the types of diets that they had been using, although insulin now permitted them wider latitude. In 1926, Geyelin, working with diabetic children, had had certain cases in which it was difficult to control the glycosuria without inducing insulin reactions. In view of the emphasis that had been laid on the harmful effect of fat in this country, it was natural to consider the possibility that the fat in his diets might be to blame. He therefore reduced the amount of fat and supplied the necessary calories with carbohydrate, prepared to use larger insulin doses, but as he states, he was "surprised" to find that the insulin requirement was not increased, and that in some adults it was actually lowered. Geyelin used diets containing 2, 3 or more grams of carbohydrate per gram of fat. Meanwhile, Sansum, Blatherwick and Bowden had reported results with insulin cases on diets high in carbohydrate, which they had come to adopt for general reasons. These papers by Sansum et al and Geyelin have been followed by others here and abroad, such as those of Rabinowitch, Porges and Adlersburg and others, to which Dr. Geyelin may refer tonight, so that now in the insulin era we are in the midst of a "high carbohydrate" movement in which we discern an awakening on this side of the Atlantic, and a revival in England and Europe, of interest in a type of diet and a problem of mechanism that has held the attention of groups of writers more or less continuously for 60 years. And in the course of the movement we see the recurrence with variations of certain conceptions and possibly also some of the errors that have been discussed at great length in the pre-insulin era. However, now we are better equipped than earlier writers to solve the theoretical and practical problem.

*Mechanism of High Carbohydrate Diets.* As stated above, the idea that led Dr. Geyelin to adopt high carbohydrate rations for children was that his diets had been too high in fat. As he is here tonight, he will correct me if I misrepresent him in stating that what he was after was low fat diets, and that in lowering the fat while keeping the calories and protein about the same, he necessarily

raised the carbohydrate. Then, having obtained his striking results, he interpreted them as due in part, at least to the positive action of carbohydrate.

The influence of the same conception concerning the injuriousness of fat is evident in the interesting experimental study of Dr. Russell Richardson of this city. Working with patients on diets of the high fat type but of moderate calorie magnitude, he kept the urine free of sugar and the blood sugar percentage within normal limits with certain fixed doses of insulin. He was then able to remove from a diet a given weight of fat and add the same *weight* of carbohydrate without changing the dose of insulin or causing glycosuria or hyperglycemia. Thus in one case the diet provided C.57, P.58, F.150, Cal.1930. The insulin dose was 46 units, the blood and urine were normal and the patient was free of insulin reactions. The fat was then lowered by 93 gm. and the carbohydrate increased by 93 gm. so that the diet provided C.150, P.58, F.57, Cal.1345. With the insulin dosage remaining the same, the blood and urine remained as before. He found that such changes could be made all at one time with patients who had been somewhat undernourished. With obese patients the experiment failed, sugar appearing in the urine when the change was made. Richardson says "There is apparently present in these patients the *influence of the body fat* which makes it impossible for them to take advantage of *the reduction of fat in the body*" and further "We feel that the ability of patients to metabolize more carbohydrate can not be due to increased tolerance for food (glucose)—No time was allowed for development of a great tolerance—The patients were also on the highest diet which they could take with the given amount of insulin—In the insulin patients if the insulin had been sufficient to allow for a marked increase in carbohydrate, it would have been sufficient to cause shock during the period of the low-carbohydrate high-fat diet." He suggests a reciprocal relation between the fat and the carbohydrate metabolism.

Now it must be said of these experiments that three changes are made simultaneously — lowering of the fat and total calories and raising of the quantity of carbohydrate. There is little question that in undernourished or even normally nourished patients who have been living on diets absolutely too low in carbohydrate it may be possible to obtain results similar in kind to those obtained by Richardson simply by adding carbohydrate, as has already been shown. Nevertheless it may be recalled that carbohydrate is convertible in the body into fat and that fat may be burned directly as such. Indeed under suitable physiological conditions a major fraction of all the utilizable carbohydrate that enters the body may be oxidized indirectly by primary reduction to fat, a two stage process in which the total quantity of oxygen consumed and the total quantity of carbon dioxide produced are the same in the end as they would be if the sugar were burned directly. Therefore, what we refer to as a patient's tolerance for carbohydrate depends not alone on his ability to oxidize sugar directly, but in a very considerable measure on his ability to burn it indirectly, that is to say—by primary conversion into fat and ultimate burning of the fat. Even if we granted the theoretical contention of some writers that fat may be changed into carbohydrate, the above statement would hold. The question may be raised as to the possible limits of fat formation from carbohydrate, and as to the relative availability of this method of sugar disposition in a fat as compared with a lean individual. As the fat reservoirs of the body fill up and the body approaches fat saturation, then, other factors remaining the same, might we not expect a slowing down of the rate of conversion of carbohydrate into fat, and a corresponding impairment of the carbohydrate tolerance? Perhaps this is what Richardson had in mind, and if so I believe that he offers a plausible theory of how too much fat in the body may lower the tolerance for carbohydrate. However, in the case of a patient who is already spare and undernourished, it would seem to me doubtful whether the removal of fat from the diet would serve the same pur-

pose. In such cases it would seem necessary to attribute any increase of the tolerance for carbohydrate to the positive action of carbohydrate itself, or to be very cautious—something contained in carbohydrate foods. The mechanism of the positive action of carbohydrate food remains problematic.

*Practical Adjustment of the Proportions of Carbohydrate and Fat.* If in the case of a given patient weighing 60 kg. general requirements had been fairly fulfilled by a diet containing 1800 calories, 240 of which were provided by 60 gm. protein, leaving 1560 non-protein calories, and if the carbohydrate amounted to 60 gm. and the fat to 146 gm. the diet would be of a relatively high fat type, and the question would rise as to whether conditions would be improved by the addition of carbohydrate and the subtraction of fat. One might then remove say 10 gm. of fat, add the calorie equivalent or 22.5 gm. of carbohydrate, observe results, and if they were desirable, repeat the process. If after 2 to 3 or 4 steps the insulin requirement were found to rise, one might stop or reverse the procedure. Or, if, after the carbohydrate had risen to 140 to 150 gm. and the fat had fallen to 85 to 80 gm. the patient felt that he was not receiving enough fat foods such as butter, cream or oil to make his menus agreeable to him, one might stop for no better reason than that. In a number of our cases in which we have followed roughly such a procedure, there have been definite advantages in raising the carbohydrate to levels between 2 and 3 gm. per kg. of body weight. I have not been struck by additional advantages resulting from further elevation of the carbohydrate using as criteria the insulin requirement per *calorie* of diet, frequency of reactions and the comfort of the patient. In some cases conditions have been less satisfactory on diets too high in carbohydrate. I have had but a limited experience with very high carbohydrate diets, and shall listen with interest to Dr. Geyelin. It has seemed to me that the most effective diet would be one on which the patient would obtain the necessary number of *calories* on the lowest possible insulin dose.

# DIABETES IN CHILDREN*

PRISCILLA WHITE
Boston

The problems of those who care for the diabetic child of today are largely five:—(1) the treatment of the uncomplicated case; (2) the prevention and treatment of the direct and indirect complications of the disease; (3) the control of emergencies which, in a few hours, can convert a controlled into an uncontrolled case; (4) the protection of the individual child; and (5) the prevention of the transmission of the disease.

The direct complications of diabetes are obviously coma and hypoglycemia; the indirect complications are the end results of uncontrolled diabetes. In the order of the frequency with which they have occurred in the series of 900 juvenile patients who have come under Dr. Joslin's care from 1898 to 1933 they are pseudo-dwarfism, arteriosclerosis, cataracts, infections of the skin, and xanthoma. The emergencies which can convert the controlled into an uncontrolled case are surgical complications, acute or chronic infections.

The treatment of the uncomplicated juvenile case is the most frequent problem. It is more involved than that of adult diabetes because it consists of two phases, initial adjustment and periodic readjustment to allow for growth and development. Furthermore, one must contend with the greater physiological and emotional instability of the child. The actual principles of treatment employed in juvenile and adult diabetes are the same, diet, insulin and exercise. In the process of desugarization we still employ undernutrition prescribing for the child's initial diet 100 grams of carbohydrate, 1 gram of protein per kilogram of body weight and enough fat to yield 30 calories per kilogram. The diet is increased daily until the desired diet

* Delivered before the joint meeting of The New York Academy of Medicine and the Medical Society of the County of New York, October 30, 1933.

for age and size of the child is attained. Prolonged observation of cases under immediate control and with normal activity has demonstrated to our own satisfaction that the following diets permitted an average gain of from one-half to three-quarters pounds a month and fulfilled our own standards for controlled diabetes namely, that the level of the sugar of the blood should be below 200 mgs., glycosuria less than 10 grams in 24 hours and the cholesterol content of the blood normal, 230 mgs.

| | | | Average diet in grams | | | |
|---|---|---|---|---|---|---|
| Age Yrs. | Cals./kg. | P./kg. | C. | P. | F. | Cals. |
| 5 | 75 | 3.0 | 140 | 60 | 70 | 1400 |
| 10 | 65 | 2.5 | 160 | 70 | 80 | 1600 |
| 15 | 45 | 1.5 | 180 | 85 | 90 | 1900 |

We still limit the carbohydrate to 200, the protein to 100 and the fat to 110 and divide the carbohydrate one-fifth for breakfast, two-fifths at noon and at night.

A caloric increase of 5 or 10 per cent is made every six months or year according to the needs of the individual child so that he may grow two inches in height and six pounds in weight annually during childhood and double this amount during adolescence.

Insulin, to juvenile patients, is given continuously from the day of diagnosis and is considered the variable in treatment whereas the diet is the relative constant. We give the maximum dose one hour before breakfast, a slightly smaller dose one-half hour before the evening meal and, after the third year of diabetes, a few units at 10 o'clock or midnight. Sometimes an even distribution every 8 hours is more efficient or the administration of insulin before each meal with or without the late night dose.

Rearrangements of carbohydrate during the three major meals or in accessory lunches, readjustments of insulin and exercise are made according to qualitative four period tests, the level of the fasting blood sugar or one taken at eleven o'clock in the morning, four o'clock in the afternoon or an hour after a meal. There can be no pattern of

treatment applicable for all cases. There can be no constant pattern for the same patient day in and day out for the regimen of the individual day governs the diabetic schedule.

The prevention of both the direct and indirect complications of diabetes constitutes half of the diabetic problem of today. The direct complications coma and hypoglycemia command the attention of those who treat juvenile diabetes because they occur more frequently in the child than they do in the adult patient. The indirect complications, the degenerative changes, command attention even more imperatively for they are more tragic when they occur in youth. They must be checked all the more vigorously because of the evidence that decreasing severity of diabetes occurs when young patients have attained full growth and development.

Coma, no longer the inevitable lethal factor of juvenile diabetics, occurs frequently, too frequently. Only 1 in 100 of our adult patients has had coma whereas 1 in 10 of our juvenile patients has recovered from one or more attacks. The reasons for this greater frequency are the acute onset of diabetes in childhood so that the first hint of the existence of the disease may occur during severe acidosis or coma and greater susceptibility to minor systemic infections, as well as more frequent dietary indiscretions. In spite of the greater frequency the prognosis for recovery in the younger patient is better. Since 1923 only one death has occurred in 97 successive juvenile admissions at the New England Deaconess Hospital. Other hospitals have an equally good record. Coma, however, cannot be passed over lightly since it is still the major cause of deaths in those children who die outside the hospitals. The cardinal signs and symptoms are invariably present but the nausea and vomiting followed by leucocytosis and abdominal pain simulate an acute surgical abdomen, the Kussmaul breathing, pneumonia so that the primary cause, acidosis, is over-looked, being unrecognized it is untreated and the child who should recover dies.

The treatment of coma in the child differs little from the treatment of coma in the adult. Insulin early and in repeated doses, the amount depending upon the size and age of the patient and the duration of the diabetes as well as the clinical severity of the coma. From 5 to 40 units are given every 15 minutes for two hours then hourly until clinical improvement is evident. Actually from 30 to over 600 units have been given in twenty-four hours. Fluid is used to combat dehydration, from 500 to 6000 c.c. of normal salt solution in the first twenty-four hours. Gastric lavage and enemata are employed to combat lack of gastro-intestinal tone. Adrenaline may be used to combat circulatory failure which, however, seldom occurs in childhood. Glucose may be resorted to if renal block is imminent and carbohydrate given up to 100 grams by mouth in the first twenty-four hours.

Hypoglycemia, caused by irregularities of insulin, diet and exercise, like coma can generally be prevented by intelligent anticipation. There is always one factor to contend with—failure of absorption of food after the administration of insulin. In the child beside the usual symptoms the quiet child and the child in tantrums must be considered hypoglycemic until otherwise proved.

The treatment of the condition is self evident, replacement of carbohydrate by mouth if the patient is conscious, by vein or under the skin if the patient is unconscious. To the unconscious patient we prefer to give a 50 per cent glucose solution intravenously. This not only replaces the needed carbohydrate quickly but tends to combat the cerebral edema which occurs in severe cases of insulin shock.

Of the indirect complications of diabetes pseudo-dwarfism is the most frequent, the easiest to prevent and to remedy. The condition is a newly recognized one. A survey of the past histories of these patients shows that dwarfism has a single cause—undernutrition. This may be produced in a variety of ways but mainly one of four. It may be the result of undernutrition treatment of the

pre-insulin era. For this the physician is blameless. One-half of the 54 pseudo-dwarfs in our own series were survivors of the pre-insulin era.

It occurs in the insulin era among those patients treated for periods of time without insulin and where the diet is persistently reduced to bring about sugar freedom. The most difficult lesson to teach parents of diabetic children is the following. When the child grows he requires more food and more insulin. In our own patients the dosage of insulin has doubled from infancy to 15 years of age practically regardless of the duration of the disease. Any increase in insulin dosage indicates to the parents that the disease has become progressively worse and they will resort to all sorts of measures to reduce the dosage of insulin or at least to maintain it at the same level, actually placing a child of 12 upon a diet calorically inadequate for an infant of one.

It occurs furthermore, in some children whose disease is uncontrolled because of diet breaking. This is mostly among the younger children for they commit dietary indiscretions secretly and the dosage of insulin is not changed. The older children have become very adept at balancing diet and insulin under the same circumstances.

The onset of the condition is insidious because at the commencement of diabetes the child is on the average two inches above the standard height for age. It would therefore take three years of complete cessation of growth before the condition became apparent. These children grow a little, at the rate of 0.5 inches a year, therefore it is not until the fifth year of diabetes that the retardation is evident. This merely emphasizes the importance of checking annual rates of growth in diabetes as well as deviations from standards.

The treatment of dwarfism consists of high caloric diet to counterbalance the high energy requirement. The basal metabolism rate of these pseudo-dwarfs was plus 18 compared with plus 11 for all diabetic children and plus 2 for tall diabetic children.

Arteriosclerosis is the next complication in order of its frequency. It has been recognized in 33 of our juvenile patients. It is a rarity in young persons as shown by our own control group and by a review of the literature in which Pearl Zeek could find the records of only 98 cases in non-diabetics covering a period of 100 years. The common causes, nephritis, lues and sepsis, have not occurred in our own cases. The two abnormal conditions which occur in diabetes are alterations of fat and of carbohydrate metabolism. In a comparison of our cases we could find little clinical correlation between arteriosclerosis and high blood sugars in children, but arteriosclerosis occurred fifteen times more frequently in the group with high blood cholesterols. In the acidosis of uncontrolled diabetes the conditions are right for the redistribution of calcium from bone, union with cholesterol esters which are unsaturated fats and final deposition in the blood vessels and in the lens of the eye. Therefore, our standards for the control of diabetes are blood sugars below 200 milligrams and cholesterol below 230 milligrams.

Cataracts have been recognized in twenty-one of the group. Here again we have found a positive correlation between abnormality of cholesterol metabolism and frequency of cataracts, but our series is too small to be conclusive.

The tragic devastation of abnormal fat metabolism in juvenile diabetes is illustrated in a patient, Case No. 4568, who developed diabetes at 12 years of age in 1922. At no time has her diabetes been under control. From 1929 to 1933 the cholesterol varied from 500 to 300 milligrams. In 1924 x-ray examination of the legs was negative. From 1929 to 1933 she had xanthoma diabeticorum, frequent attacks of acidosis, carbuncles and abscesses. In September, 1933 she returned to the clinic nearly blind—and hopelessly so because of retinitis proliferans and with well marked calcification of the vessels of the legs.

Failures in the treatment of the young diabetic of today are not due to the type of treatment employed but to the lack of treatment or uncontrolled disease. This we consider hopeful but control of diabetes depends upon the patient—an unfortunate situation in childhood since the child lacks wisdom, therefore infinite tact, patience and understanding must be applied to the individual child and his problems.

Almost any degree of abnormal health in the juvenile patient must be considered an emergency, because it is slight deviations from normal which precipitate acidosis and coma even in a fairly well controlled case in as short an interval as twelve or twenty-four hours. Therefore parents and patients besides being taught to notify the family physician immediately in case of illness must be taught simple rules for the management of days of illness. These are the same as our own for pre- and post-operative treatment. Insulin every two, four or six hours depending upon the degree of reduction with the Benedict test. The child of fifteen—15 units if red or orange, 10 if yellow, 5 if yellow green, to the child of ten—10 units if red or orange, 5 if yellow or yellow green—to the child of five—5 units if red or orange, 3 if yellow. The diet should be reduced to from 100 to 150 grams of carbohydrate and a negligible amount of protein and fat. Such a diet could be one and one-half or two and a half quarts of milk.

In any discussion of the care of the diabetic child the inheritance of the disease must appear for it is this particular generation which must be taught to safeguard the next. It was the child in fact, who first convinced us of the importance of inheritance, revealed its latency, and suggested the mode of transmission.

We are dealing with a complicated problem. Obvious inheritable conditions are evident at birth or in early childhood. This is not the case with diabetes, few patients developing the disease in early life and the majority in middle or late life. Therefore it cannot be inheritance alone but

inheritance plus some other factor in the internal or external environment which permits the expression of the disease. Furthermore, with the exception of the mating of diabetic and diabetic we have to start an analysis such as ours backward since the only way we can identify an individual as a carrier of a disease is by the fact that he has produced an offspring with the disease. Increasing duration of diabetes tends to reveal the carrier history for among diabetic children 1 in 5 has a diabetic relative when first seen, 1 in 3 after five years and every other one after ten years.

The conclusion that diabetes is inherited as a Mendelian recessive is based on (1) the finding of a greater evidence of diabetes in a diabetic than in a control population selected at random; (2) the demonstration that the Mendelian law applied to a large series of case histories selected at random; (3) the check on the case history method by the direct examination of the blood and urine of a small series of families, diabetic and control, not selected at random but selected so that we have an even distribution of families in the three types of Mendelian population.

The statistically significant difference between the occurrence in a diabetic and control population was this. In the diabetic population 8 per cent had parents with the disease, in the control population 2 per cent. Diabetes occurred ten times more frequently in the brothers and sisters of the diabetics than it did in the control population.

When we applied the Mendelian hypothesis to our case histories, from the statement above, it was evident that we would have to keep to the recessive side of the pattern. If diabetes were inherited through a simple dominant gene one would expect more instances of parental disease.

Mendelian expectations on a recessive basis were fulfilled when we based our analysis upon two facts—age incidence and survivorship. The age incidence factor is

this. In each consecutive thousand of our own cases the same number have age of onset in the first decade, in the second decade, etc.—our clinic, other American clinics, European clinics.

The survivorship factor is this. Persons predestined to the disease live and die at the same rate as those not predestined. Thus the predestined diabetic can contract tuberculosis and typhoid fever and die of these conditions or be killed in an automobile accident just as a person not predestined. From this a prediction curve can be constructed. This represents the incidence of diabetes in a diabetic population and lies slightly below the age at onset tables which appear in the standard text book. This analysis was done by Dr. Pincus at the Department of Physiology at Harvard University and a preliminary report has already been published by Dr. Pincus and myself in the American Journal of Medical Sciences.

Although the result of this work seemed convincing it was obvious that, dependent upon case histories, patients might be incorrectly classified either as diabetic or non-diabetic and early or latent cases unrecognized. The third part of the study answered this objection, since it confirmed case histories in most instances and although it revealed latent cases they occurred where we expected them and did not alter our results. Among the cases tested most severely—by tolerance test—were 87 members of diabetic families and 52 controls. Eight hyperglycemic curves were found—all in the diabetic families. Four other abnormal curves were found all save one in the families of diabetic individuals.

If the 10 per cent increase is incorporated it altered the type of cross once—an unidentified diabetic parent was recognized. It brought one family into the series revealing a child with the disease. It revealed one sibling in the carrier x carrier cross, two in the diabetic x carrier cross and two in the diabetic x diabetic cross.

The analysis furthermore proved the crucial test of the theory which rests with the mating of diabetic and diabetic. Twenty-three such families were studied. It is the crucial test because, first this is the only group in which the identity of the parents is stabilized. They are all diabetic and will remain so and second all the children of two diabetics should eventually develop the disease. If our hypothesis has been correct we should not only have predicted the number of diabetics in the children of our twenty-three conjugal families but also the age at onset on our prediction curve. We expected 14 of the 109 children to be diabetic—16 clinical cases were found and two others had hyperglycemia. Furthermore in most instances, in fact 6 out of 8 decades, the number expected in each decade appeared in accordance with the prediction curve.

Our hypothesis holds. What does this mean? It means first that we have a relatively small group upon which to concentrate for the second etiological factor and second that the control of diabetes is possible. For if a diabetic marries a diabetic all the children are predestined diabetics but only 0.2 per cent will develop it in the first decade, 3 per cent in the second, 5 per cent in the third, 10 per cent in the fourth, 20 per cent in the fifth, 30 per cent in the sixth, 50 per cent in the seventh, 60 per cent in the eighth. If a diabetic marries a carrier one-half are predestined to diabetes. (One-half the prediction curve.) If a carrier marries a carrier one-fourth are predestined to diabetes (one-quarter of the prediction curve) but if a diabetic marries a pure non-diabetic none of the children are predestined.

But not only must we train our diabetic children to marry into pure non-diabetic families but we must also carry this teaching to the children of diabetics for they represent true and insidious carriers of the disease.

Five points I wish to re-emphasize. Deaths from coma and hypoglycemia even their occurrence are needless today. Pseudo-dwarfism is insidious of onset, results from under-

nutrition even in the insulin era, but should never occur. Degenerative complications, arteriosclerosis and cataracts are found even in childhood but only when the disease is uncontrolled. There appears to be a positive correlation between abnormal fat metabolism and degenerative changes; and last, the capacity for developing diabetes is transmitted as a simple Mendelian recessive trait.

1. Zeek, Pearl, *Arch. Path.*, 1930, *10*, 417.
2. Pincus, Gregory and White, Priscilla, *Am. Jl. Med. Sci.*, 1933, *186*, 1.

# CONSIDERATIONS BEARING ON THE SUCCESSFUL TREATMENT OF DIABETES MELLITUS*

JAMES RALPH SCOTT

The cause of diabetes is unknown. Its successful treatment therefore, in the present state of our knowledge, depends first upon a consideration of the various factors that are known to contribute to its onset. There are several of these contributory factors. Perhaps the most important are:

1. *Obesity.* Obesity certainly is a factor in diabetic deaths, for Dublin has shown that extreme overweights have a mortality eight and a half times in excess of normal weights, and thirteen times the rate shown in underweights—he is speaking here of diabetic deaths only. Rabinowitch, of the Montreal General Hospital, states it tersely when he says, "When a man adds 10 pounds to his belt line, he subtracts one year from his life line." Certainly, treatment of diabetes to be successful must stress the importance of overweight as a predisposing cause.

2. *Heredity* appears to be a factor in the incidence of the disease. Recent investigations—and particularly a scholarly piece of work published three months ago by White and Pincus, of Boston—strongly suggest that diabetes may be inherited as a Mendelian recessive trait. If this be so, it gives hope to the diabetic patient who wishes to marry and have children, provided the marriage be to a non-diabetic person. Conversely, marriage of two diabetic persons would be sure to produce diabetic children, and should be avoided. The prevalence of diabetes among Jews as a race is probably an hereditary phenomenon.

3. *Age and Sex* are factors influencing the incidence of diabetes. The greatest mortality from diabetes occurs in the 5th and 6th decades of life in both sexes. Moreover,

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the death rate among women is rising much more rapidly than that among men until now, in this age group, more than twice as many women as men die of the disease. Apparently after middle age something happens to women that does not happen to men to account for this increasing mortality. Dr. Mosenthal rightly stresses the importance of pregnancy as a contributing factor, for it is definitely known that pregnancy diminishes the glucose tolerance in diabetic women for a considerable period of time, and possibly permanently. That the incidence of diabetes among married women and widows is greater than among single women also supports this thesis.

4. *Endocrine imbalance* may be a contributing factor in the onset of diabetes. We know that in the presence of hyperthyroidism for example diabetic patients show an insulin resistance. Diabetic girls develop a diminishing glucose tolerance at the onset of menstruation. Recent animal experiments show that in de-pancreatized dogs fatal diabetes can be prevented by the removal of the hypophysis.

In an appreciable number of human autopsies done on patients dying of diabetes, no destruction of the islands of Langerhans can be demonstrated. All these facts suggest that diabetes is something more than a disease of the pancreas alone, and it may be that further research in this fertile field will reveal the actual, immediate cause of the disease.

5. *Psychic or nervous shocks* have been thought to be contributory causes of diabetes. It has been proved that emotional stress affects the glucose metabolism even in normal persons, and we know it diminishes the glucose tolerance in diabetics. It may be that the stress and strain of modern, urban civilization is a factor in the increasing incidence of diabetes. Two facts supporting this thesis are, first that diabetes is more prevalent in the city than in the country, and second, that the death rate from diabetes among negroes in our northern cities is twice that of the same race in the South.

6. *The changing dietary and living habits* of our people may be a factor in the increasing prevalence of diabetes. A diet consisting mostly of cereals, fruit, vegetables and dairy products has replaced one in which meat predominated. The per capita consumption of sugar has increased over 300 per cent in the past 60 years. At the same time there has been a mass migration from the country to the city, and the number of manual laborers has diminished. This is significant, for in all mortality tables classified according to occupation laborers have the lowest place.

While this brief review of some of the factors which appear to influence the incidence of diabetes does not solve the problem, it is hoped that a further study of them may throw some light on the essential nature of the disease, and will have a bearing on its successful treatment.

In the actual application of our knowledge to the treatment of the patient, the most important consideration of all is the *education of the patient* in the management of his own case. One has only to check over one's own list of patients to realize that those who show the best results are the ones who know the most about their disease. Every diabetic patient should know how to do three things—

1. Test his urine for sugar.
2. Calculate his diet (by weight or measurement).
3. Give himself insulin.

Moreover, he should learn that the criteria of successful treatment are—

1. A sugar free urine.
2. A normal blood sugar.
3. A weight within 10 per cent below the normal for age, height and sex.

All except the mildest cases should be placed on a weighed diet from the start. At first the urine should be tested four times daily, before breakfast, and one hour after each meal. Insulin is given according to these tests,

and can be increased or decreased to meet the patient's requirements. A blood sugar determination should be done at least once a month. As the patient's knowledge of his disease improves, this regime may be modified at the discretion of the physician.

The protein requirements of adults should be one gram per kilogram of body weight, and that of children from 1.5 to 3 grams per kilo. A fastidious calculation of the theoretical caloric needs of the patient is unnecessary. After the protein requirement is calculated, the caloric content of the diet can be obtained by giving enough carbohydrate and fat to maintain the patient at his ideal weight, *always* giving more carbohydrate than fat.

A good diet to start on, and one which I use on both private and ward patients, is C 120, P 65, F 50—1190 cal. Any other diet would do just as well. The point is that each physician should decide on a reasonable diet that satisfies his particular idiosyncrasies, and then increase or decrease it depending upon whether he wants the patient to gain or lose weight. *The patient's weight is the best guide to his caloric requirements, and his four daily urine tests are the best guide to his insulin requirements.*

Some time ago I decided to chart the course of a patient who has been under my care for 7 years. She is single, a school-teacher, and a severe diabetic, making it necessary to weigh every gram she eats. She works hard, goes to the theatre, swims in the summer and does everything her associates do. Her weight is normal. Much to my surprise, I found that for the past two and a half years she had been doing all this on a diet of 950 calories—C 120, P 50, F 30. Fortunately I had not been feeding this patient on the basis of her theoretical caloric requirements, for if I had, she would have been the victim of obesity by this time. To guard against any possible Vitamine A deficiency in this low fat diet, she takes one capsule of Haliver oil daily, which appears to supply her needs.

I should like to close with a warning against giving too much insulin to our older diabetic patients. Nathanson, of the University of Minnesota, showed by autopsies on 100 diabetics that "the incidence of *coronary sclerosis* is approximately six and a half times greater in diabetics than in non-diabetics". This is a very significant finding, for we know that the coronary heart muscle needs more glucose to function properly than the normal heart muscle does. Therefore, *if* coronary sclerosis is more common among diabetics, and *if* a low blood sugar is harmful to these damaged heart muscles, the safest course to pursue is to treat all diabetic persons over 50 years of age as potential heart cases, and to maintain an adequate blood sugar level at all times. Consequently, I have adopted as a normal blood sugar for patients in this group 150 mg. per 100 c.c. of blood.

In the time allotted I have been able only to touch upon a few of the general considerations bearing on the treatment of diabetes. A detailed account of the more important phases of treatment is given by my colleagues on this program.

# TREATMENT OF DIABETIC COMA*

HERMAN O. MOSENTHAL

The principles guiding therapy in diabetic coma have changed completely during the last decade. Ten years ago, acidosis was the synonym for diabetic coma accepted by the clinician. At that time, the main effort at controlling this disturbance, which was usually fatal, was the administration of bicarbonate of soda in large amounts, by mouth, vein, rectum and hypodermoclysis. This was done for the purpose of forcing the elimination of accumulated acid by way of the kidneys and providing adequate bases for internal respiration. Bicarbonate of soda is just as useful today in this regard as it was ten years ago, but it has become unnecessary since diabetic coma is no longer treated as an acidosis but as a diminished power of the body to assimilate glucose.

Insulin, perfected by Banting, Best and the Toronto group of scientists, has enabled physicians to manage diabetic coma, not as a poisoning by acid, but as an intoxication due to the marked impairment of the ability of the tissues to utilize glucose. This principle was appreciated long ago but it could not be applied because, without insulin, clinicians could not light the fire of the carbohydrates in which the fats must be consumed. This can be accomplished now, so successfully that most cases can be revived within a few hours.

The most important point in the successful treatment of diabetic coma is the proper use of insulin; this matter will be taken up first and the remaining parts of the treatment subsequently.

The early treatment of this condition is very essential. Diabetic patients should be instructed that if they have an infection, if they become subject to nausea or vomiting,

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if their respiration becomes deeper than usual, or if they feel out of sorts in any way, they should inform their physician immediately.

Insulin should be administered in comparatively small doses and at frequent intervals. In this way, more carbohydrates are digested per unit of insulin than with a single large dose; a huge amount of insulin at one time—100 to 400 units as have been given—may result in hypoglycemic reactions for many hours subsequently; this is a real danger which has to be guarded against; it is worth remembering that more insulin can be given with an almost instantaneous effect on the carbohydrate metabolism, but insulin cannot be removed from the body, nor can extremely large doses be readily compensated for by the ingestion and intravenous injection of glucose. The first dose of insulin should be given partly by vein to insure immediate results, and partly subcutaneously so as to prolong its action; 20 units by vein and 20 units subcutaneously is usually sufficient.

After this initial treatment, insulin in doses of 10 to 20 units should be given subcutaneously every hour or two hours. The amount and the frequency of the doses are regulated in the first place according to two signs: the depth of the respiration is a good measure of the persistence and intensity of the acidosis; another criterion of the effect of insulin upon the coma, naturally, is the degree of recovery from the unconscious state.

In the second place, the result produced by the insulin should be judged by an hourly or two-hourly careful examination of the urine. This should be obtained by catheter if necessary. The urine is examined for sugar and for diacetic acid. If glucose persists in the urine in appreciable quantities, the hourly or two-hourly subcutaneous injection of insulin is continued. When sugar is present in the urine in only small amounts and there is need for further insulin effect, then glucose must be given by mouth, vein or subcutaneously in order to furnish the injected in-

sulin, sugar upon which it can act. The subject of the administration of glucose in diabetic coma will be taken up in greater detail later on.

The presence of diacetic acid in any specimen of urine as shown by the ferric chloride test, calls for the utilization of more glucose and consequently the continued use of insulin. The same is true of the persistence of the physical signs of coma, namely, unconsciousness and the deep breathing.

The careful and painstaking procedure according to this outline usually results in the recovery of consciousness within a few hours.

The equipment necessary for this treatment should be kept in readiness by every physician. It consists of two four-ounce bottles—one of Benedict's solution and one of ferric chloride solution of 10 per cent or stronger—four test tubes preferably of pyrex glass so that they will not break on heating, one alcohol lamp, 400 units of insulin, and a hypodermic syringe. This is all that is absolutely essential for emergency use.

The determinations of blood sugar and the $CO_2$ combining power of the blood, are exceedingly valuable and comforting determinations for the guidance of treatment. However, they are not absolutely necessary. Furthermore, unless the patient is in a hospital with adjacent and functioning laboratories, the reports would come in too slowly to be of much help. Decisions must be made regarding the regulation of insulin and glucose every hour or two, and the results of laboratory tests that are reported late during these intervals, are past history and not of great value for the control of the immediate handling of the situation.

Although it interrupts the flow of thought, I should like to call attention here to a matter which Dr. Bolduan of the Department of Health in New York City, called to my attention. Dr. Bolduan sent out questionnaires regarding the diagnosis and treatment of cases of diabetic coma

which terminated fatally. Many of the answers indicated that the patients had succumbed to diabetic coma without receiving insulin. According to the answers given, this astounding fact apparently is not the error of the physicians, but is due to the unwillingness of patients or their families to submit to insulin therapy. Why there should be this deep-seated objection to the life-saving benefits of insulin, it is difficult to understand. However, from these questionnaires it becomes perfectly evident that the education of diabetic patients and their families must be carried out more effectively. The same antagonism to the use of insulin is being encountered as there has been to other life-saving measures such as vaccination and diphtheria antitoxin.

When the urine becomes free of diacetic acid, the patient returns to consciousness and the breathing is no longer deeper than normal, then insulin may be given three or four times a day and an appropriate diabetic diet resumed.

While the insulin brings about the adequate utilization of glucose, and through this, the complete oxidation of fatty acids and does away with the acidosis and coma, there are certain urgent effects of the inability to assimilate glucose in the comatose patient that must be taken care of. Some patients never recover consciousness although they are relieved of the acidosis, and others succumb after the coma is set aside, to the ravages which the diabetes and acidosis have imposed upon them. Such complications are attributed principally to dehydration. The dehydration comes about in diabetes largely through the polyuria incident to the elimination of glucose, and to the loss of basic material accompanying the excretion of excessive quantity of acids in the urine. Marked dehydration results in a rapid pulse rate, low blood pressure, impaired cardiac power, diminished surface temperature, oliguria and constipation.

Great care must be taken to meet these complications so as to prevent a fatal issue which may occur even though the coma itself has been overcome.

Every patient should be kept as warm as possible by the usual methods. Fluids should be administered in good quantities by mouth, subcutaneously or intravenously; possibly all three methods may be employed. At times there is vomiting or gastric distention. In this event the stomach may have to be washed out and only the intravenous and subcutaneous routes used for the administration of fluid. The fluid should consist of saline solution, according to the precepts given by Peters and his coworkers, to aid in the restoration of the proper acid-base equilibrium of the body and also to favor the retention of fluid.

There is some controversy as to whether glucose should be routinely administered, or not. It has been my belief that glycosuria favors polyuria and therefore there is a loss of fluid to the body when sugar is present in the urine. Furthermore, it would seem entirely superfluous to add glucose when the quantity of insulin administered to the patient has not succeeded in utilizing the excess of sugar which already exists within the body. Consequently, our patients have been given glucose only when the urine showed a low concentration of sugar, approximately less than 0.5 per cent, and when further immediate administration of insulin was indicated. This method of balancing insulin and glucose has proved to be satisfactory.

For the cardio-vascular involvement, we have resorted to digitalis with the idea of digitalizing the patient within 24 to 48 hours. When insulin was first employed in the treatment of diabetic coma, it was our experience that some of the cases succumbed to pneumonia after the coma had been set aside. The impression was gained that this was the result of pulmonary congestion existing during the period of unconsciousness. Since digitalis has been resorted to, the pneumonic complication has been absent. The rapid pulse rate, the low blood pressure are nearly always present in diabetic coma and are ample evidence of the need for cardio-vascular stimulation.

If rapid response is not obtained after the first rush of activity in caring for these patients is over, it is necessary to think of possible complications, as the presence of infection, an over-active thyroid, apoplexy. Such co-existing diseases have to be met on their own grounds and given due attention.

The treatment of diabetic coma has, through the availability of insulin, become one of the most simple and direct therapeutic problems in medicine. It is exacting in its demands upon the physician, the nurse and the patient, but the splendid results amply reward the effort.

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# THE TREATMENT OF DIABETES WITH DIETS NORMAL IN CARBOHYDRATE AND LOW IN FAT*

H. Rawle Geyelin

In October, 1925 before the Section on Diseases of Children of the Pennsylvania State Medical Society, we reported the effects of feeding normal diets to insulin treated diabetic patients. This report was extended by further observations during the last eight years and a more extensive summary of our findings and conclusions on a much larger group of patients was reported before the American College of Physicians in February, 1933. In these two previous reports we emphasized the fact that each unit of insulin was capable of oxidizing more grams of carbohydrate when the patients were fed on diets in which the amount of carbohydrate, protein and fat approximated the proportionate and actual amounts of these foods as found in normal diets than when the older routine diabetic diets containing a preponderance of fat were given. These findings have been corroborated by Sansum and Rabinowitch and many other observers during the past eight years.

The purpose of the present communication is to emphasize certain effects upon the clinical course of diabetes which we have noted following the exhibition of these normal diets in insulin treated cases of diabetes. First, we propose to present data demonstrating the disappearance of hypercholesterinemia following the administration of normal diets. For this purpose we have collected 40 cases of diabetes who had all been treated with insulin together with diets high in fat and low in carbohydrate and who were subsequently transferred to diets containing normal proportions of carbohydrate, protein and fat. Of these 40 patients, 26 showed cholesterol figures that were greater than normal after varying periods on high fat or

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low carbohydrate diets. The remaining 14 cases showed blood cholesterol figures that were within the normal range. All these patients had been receiving the low carbohydrate high fat type of diabetic diet for at least one year before the change to the normal type of diet was made. Four of the patients had been receiving a comparatively low carbohydrate high fat type of diabetic diet for 6 years or more before treatment with the normal carbohydrate diet was instituted.

As an illustration of the type of diets which were being fed to most of the patients prior to their transfer to the high carbohydrate diet, we may cite only 3 cases out of the group of 40. First, H. N., case G-2376, male, 18 years of age, who first presented himself for treatment June 4th, 1932. His diabetes was first discovered January, 1930 and his diet from that time until June 4th, 1932 had been approximately 80 grams carbohydrate—90 grams protein —210 grams fat. He was receiving insulin three times a day, the total insulin dosage being 83 units per day. With this diet and insulin dosage he was able to remain free from sugar and also free from insulin reaction. At the time of his first visit his blood sugar was .247 per cent and his blood cholesterol .279 per cent and a trace of sugar was found in his urine. The diet was changed immediately to 325 grams carbohydrate—90 grams protein —80 grams fat and he was able to continue sugar free for the next year on a dose of insulin which never exceeded 52 units per day and which sometimes went as low as 42 units per day. His blood cholesterol has dropped to below .200 per cent and it has remained at this level continuously up to the present time. During this period the patient has gained 6 pounds in weight and ¾ inch in height. He has had no insulin reactions and his sense of well being is greatly improved. He insists that he has much greater physical endurance.

H. G., case G-2373, male, 18 years of age, first came for treatment February 24th, 1932. Diabetes had existed for 9 years. During the last 6 years of this time patient had

been on a diet of 65 grams carbohydrate—80 grams protein—200 grams fat with steadily increasing insulin until during the year prior to his admission he was taking 60 units of insulin per day and showing constant glycosuria. His blood cholesterol at the time of his first visit was .389 per cent; his blood sugar was .247 per cent; his urine contained 4.4 per cent sugar. The number of grams of carbohydrate per unit insulin was 1.9. His weight was 118½ pounds with considerable edema. His diet was changed to 300 grams carbohydrate—85 grams protein—75 grams fat and it has been gradually increased to 425 grams carbohydrate—85 grams protein—75 grams fat during the past 18 months. His insulin requirements are now 45 units per day and have been since January, 1933. He is continuously sugar free and has gained 11 pounds in weight and ½ inch in height.

W. I., case G-2443, male, age 22 at the time of first visit on April 5th, 1933. Has had diabetes since April, 1932, and his diet has been 150 grams carbohydrate—120 grams protein—190 grams fat with 65 units of insulin per day. Says he has been sugar free for the past year. At his first visit his blood sugar was .125 per cent; his blood cholesterol was .368 per cent; his urine was sugar free. His diet was at once changed to 350 grams carbohydrate—120 grams protein—90 grams fat; his insulin was reduced to 52 units per day. On this diet and insulin dosage patient remained sugar free and within 5 days the blood cholesterol was reduced to .257 per cent. One month later it was .142 per cent. Patient has remained sugar free and at the present time—October 25th, 1933—he is on a diet of 375 grams carbohydrate—100 grams protein—90 grams fat. The insulin requirement is 45 units per day and he has remained steadily sugar free.

Similar reduction to normal of the blood cholesterol has ensued in all the 26 patients alluded to above after the transfer from a diet high in fat and low in carbohydrate to one with the normal relationship of carbohydrate to fat.

It seems appropriate at this point to explain what is meant by a normal diet. By direct experiment we have found with a small group of normal individuals and with all of the present group of diabetics, that when left to their own devices, these patients, including the normal group, eat diets which contain carbohydrate, protein and fat in approximately the proportion of 4-1-1. Not all of these diabetic patients have been permitted to eat as much carbohydrate in relation to fat as this. In many of our diets, for example, the relation of carbohydrate to fat has been approximately 3 or 3½ to 1. We have found, however, that there are a few patients whose blood cholesterol does not return to normal limits until the proportion of carbohydrate to fat in the diet has reached that of 4 to 1.

The length of time which we have found is necessary to reduce the blood cholesterol after these changes in diet have been instituted varies from 1 to 8 weeks but in most patients the reduction of pre-existing high blood cholesterol to normal occurs within 2 weeks. In one case we have conducted the following control experiment: a diabetic boy, M. H., case G-2152, 9 years of age at the time of his first visit on November 20th, 1929, was put on a normal diet with 16 units of insulin in the morning and 16 units at night and maintained on this diet 2 years. During this period of time his blood cholesterol was always within normal limits. In November, 1931 his diet was changed to 70 grams carbohydrate—90 grams protein—150 grams fat. This diet was maintained for 8 months, at the end of which time he had developed hypercholesterinemia. Incidentally, the amount of insulin which he required during this low carbohydrate period was equal to the amount which he had required when his blood cholesterol was within normal limits on the normal carbohydrate diet. In May, 1932 he was returned to the normal diet and within 3 weeks his blood cholesterol had again reached normal limits.

The second observation which we wish to emphasize is one which we have called attention to in previous com-

munications, namely, the increased effectiveness of insulin in the oxidation of carbohydrate which follows the administration of normal diets as compared with the effectiveness of insulin observed when patients have been on a low carbohydrate high fat diet. This effect has been noted in all cases and is striking. It is true that the increased effectiveness of insulin does not occur immediately in some few patients and in 4 patients was not striking until 6 months after the transfer from high fat to normal diet had taken place.

This increased effectiveness of insulin following the substitution of a normal diet for one relatively or absolutely high in fat is apparently a permanent effect. In 21 patients who comprise the original group of diabetics receiving this diet, there has been no appreciable loss of insulin effectiveness after 8 years of continuous administration of a normal diet.

Many children who had previously been on lower carbohydrate higher fat diets, had gained little or no weight and had not grown in height for 2 or 3 years have gained as much as 15 pounds in weight and 3 inches in height in one year. The gain in sense of well being, physical strength and endurance has been noted in nearly all the cases.

In conclusion, all patients who have received the normal or higher carbohydrate lower fat diet after a period of several years on the lower carbohydrate types of diet (with relative or absolute high fat) demonstrate the following facts:—

1—Hypercholesterinemia, where it has previously existed, is abolished.

2—Increased insulin effectiveness as judged by the number of grams of carbohydrate that each unit of insulin is capable of oxidizing.

3—Resumption of normal growth in weight and height.

4—Increase of physical well being, muscular strength and endurance.

W. I. CASE G-2443. MALE.

| Date | COH | Pro. | Fat | Total COH | Calories | Insulin | Total Insulin | Urine Sugar | Blood Sugar | Blood Chol. | COH Grams per U. Ins. | Age | Wt. | Ht. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 April (onset) | 100 | 50 | 50 | 130 | 1050 | 4 units for 4 days, then stopped | | | | | 32.5 | 21½ | 135 | |
| Aug. | 150 | 120 | 180 to 190 | 222 | 2745 | 25-25-15 | 65 | sugar free | | | 3.4 | | | |
| 1933 | | | | | | | | | | | | | | |
| April 5 | 350 | 120 | 90 | 422 | 2690 | 30-5-20 | 55 | sugar free | .125% | .368% | 7.5 | | 145 | 5'10¾" |
| April 10 | 350 | 120 | 90 | 422 | 2690 | 28-0-14 | 42 | sugar free | .115% | .257% | 10 | | 147 | |
| May 8 | 350 | 120 | 90 | 422 | 2690 | 26-0-14 | 40 | sugar free | | .142% | 10.5 | | | |

H. G. CASE G-2373. MALE.

| Date | COH | Pro. | Fat | Total COH | Calories | Insulin | Total Insulin | Urine Sugar | Blood Sugar | Blood Chol. | COH Grams per U. Ins. | Age | Wt. | Ht. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1923 (onset) to 1932 (approx.) | 65 | 80 | 200 | 113 | 2380 | 30-0-30 | 60 | | | | 1.9 | 9 | | |
| 1932 | | | | | | | | | | | | | | |
| Feb. 24 | 300 | 85 | 75 | 351 | 2095 | 35-5-25 | 65 | | .241% | .389% | 5.4 | 18 | 118½ | 5′3⅞″ |
| March 4 | 350 | 80 | 80 | 398 | | 35-0-23 | 58 | | .179% | .222% | 6.8 | | 121 | |
| June 22 | 400 | 85 | 80 | 451 | | 30-0-20 | 50 | | .119% | .146% | 9.0 | | | |
| 1933 | | | | | | | | | | | | | | |
| Feb. 6 | 425 | 85 | 80 | 476 | 2760 | 20-0-25 | 45 | | .125% | .189% | 10.6 | | 133½ | 5′4⅜″ |
| June 21 | 425 | 85 | 80 | 476 | 2760 | 20-0-25 | 45 | | .101% | .195% | 10.6 | | 129⅛ | 5′4⅜″ |

H. N. CASE G-2376. MALE.

| Date | COH | Pro. | Fat | Total COH | Insulin | Urine Sugar | Blood Sugar | Blood Chol. | COH Grams per U. Ins. | Age | Wt. | Ht. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1930 | | | | | | | | | | | | |
| Jan. (onset) | | | | | | | | | | 15½ | 98 | |
| Oct. | 50 to 100 | 90 | 180 to 250 | 124 | 83 | | | | 1.5 | | 106 | |
| 1932 | | | | | | | | | | | | |
| June 4 | 325 | 90 | 80 | 379 | 65 | plus to plus minus | .247% | .269% | 5.8 | 18 | 140 | 5'7" |
| June 9 | 325 | 90 | 80 | 379 | 65 | minus | .259% | .200% | | | | |
| Sept. 16 | 325 | 90 | 80 | 379 | 52 | plus minus | .196% | .216% | 7.2 | | 139¾ | 5'7⅜" |
| Nov. 8 | 325 | 90 | 80 | 379 | 55 | occ. | .156% | .191% | 6.8 | | 139⅛ | 5'7½" |
| 1933 | | | | | | | | | | | | |
| Feb. 3 | 325 to 350 | 90 | 80 | 379 to 404 | 54 | plus to plus minus | .091% | .192% | 7.0 to 7.5 | | 144½ | 5'7½" |
| Sept. 13 | 350 to 375 | 90 | 70 to 80 | 404 to 429 | 57 | 1 plus | .212% | .214% | 7.1 to 7.5 | | 146½ | 5'7¾" |

# SEVENTH ANNUAL GRADUATE FORTNIGHT

## OF THE NEW YORK ACADEMY OF MEDICINE

*A Postgraduate Two Weeks Devoted to*

## DISEASES OF THE GASTROINTESTINAL TRACT

OCTOBER 22 TO NOVEMBER 2, 1934

*The Program Comprises*

AFTERNOON CLINICS, EVENING MEETINGS AND A SCIENTIFIC EXHIBIT

## I. HOSPITAL CLINICS

**Specially arranged clinical programs will be presented in sixteen of New York's leading hospitals. Among the clinicians who will participate are:**

| | | | |
|---|---|---|---|
| G. B. Bader | W. B. Farnum | J. M. Lynch | M. A. Rothschild |
| George Baehr | Hermann Fischer | A. B. MacLean | T. H. Russell |
| F. W. Baldwin | Ella Fishberg | Constantine MacGuire | F. B. St. John |
| F. W. Bancroft | L. F. Frissell | A. R. Mandel | L. F. Sanman |
| C. A. Barrett | Ross Golden | W. W. Maver | Bela Schick |
| F. H. Bartlett | A. W. Grace | F. L. Meleney | H. F. Shattuck |
| Fenwick Beekman | Carl Greene | H. W. Meyer | M. N. Shuster |
| G. E. Brinkley | R. H.Halsey | W. H. Meyer | DeWitt Stetten |
| A. S. Blumgarten | Joseph Harkavy | T. H. Morris | W. H. Stewart |
| Linn Boyd | I. W. Held | C. H. Nammack | Alfred Stillman |
| E. C. Brenner | Julius Hertz | G. T. Pack | Mills Sturtevant |
| T. W. Carey | J. W. Hinton | Douglass Palmer | R. P. Sullivan |
| H. W. Cave | C. P. Howley | H. S. Patterson | H. C. Thacher |
| J. E. Connery | W. M. Hunt | Marshall Pease | C. J. Tyson |
| A. C. Crump | H. E. Isaacs | Edward Peterson | Roy Upham |
| C. W. Cutler, Jr. | F. E. Johnson | Otto Pickhardt | P. P. Vinson |
| Roger Dennett | E. L. Kellogg | A. J. Quimby | W. L. Watson |
| E. J. Donovan | J. S. Leopold | H. A. Rafsky | A. O. Whipple |
| G. F. Dudley | Richard Lewisohn | E. J. Riley | W. C. White |
| Max Einhorn | Leopold Lichtwitz | Kingsley Roberts | I. O. Woodruff |
| A. A. Epstein | R. F. Loeb | Nathan Rosenthal | F. C. Yeomans |

## II. EVENING SESSIONS

**The subjects and speakers at Academy meetings will be:**

General principles involved in the diagnosis of gastrointestinal diseases ..... Harlow Brooks, Walton Martin, Robert E. Pound

The applied physiology of the innervation of the gastrointestinal tract ..... A. C. Ivy

Constipation ..... Henry James Spencer

Diarrhea ..... John L. Kantor

Diseases of the esophagus ..... Carl Eggers

Functional and nervous diseases of the stomach ..... Burrill B. Crohn

Diseases of the pancreas, especially acute pancreatitis and its treatment ..... John Douglas

Disorders of the gastrointestinal tract in children ..... Rustin McIntosh, W. McKim Marriott, Charles E. Farr

So-called chronic appendicitis ..... Charles F. Tenney

Acute appendicitis ..... John E. Jennings

Peritonitis ..... Chas. Gordon Heyd

Peptic ulcer ..... Arthur F. Chace, Eugene H. Pool

Carcinoma of the stomach ..... Fordyce B. St. John

Jaundice ..... Reuben Ottenberg

Gallbladder and biliary passages ..... William W. Herrick, Allen O. Whipple

Tumors of the colon ..... John F. Erdmann

Diseases of the anus and rectum, including tumors ..... Harvey B. Stone

Colitis ..... Walter A. Bastedo, Thomas T. Mackie, Francis W. O'Connor

Intestinal obstruction ..... Arthur M. Wright

Diverticulitis ..... Dean Lewis

## III. SCIENTIFIC EXHIBIT

**An extensive scientific exhibit bearing upon the various aspects of the general subject will be held at the Academy concurrent with the Fortnight. Lecture demonstrations at regular intervals will be given by many of the exhibitors.**

A COMPLETE PROGRAM AND REGISTRATION BLANK WILL BE MAILED ON REQUEST

# PROCEEDINGS OF ACADEMY MEETINGS
# MAY

## STATED MEETINGS—May 3

I. EXECUTIVE SESSION—a. Reading of the Minutes; b. Election of Fellows and Members; c. Presentation of diplomas.

II. THE HERMANN MICHAEL BIGGS MEMORIAL LECTURE—*"Causes and Prevention of Blindness"*—Arthur J. Bedell, Albany.

## THE HARVEY SOCIETY (IN AFFILIATION WITH THE NEW YORK ACADEMY OF MEDICINE) May 17

THE EIGHTH HARVEY LECTURE, "The Nervous Mechanism of Circulatory Control," Detlev W. Bronk, Johnson Professor of Biophysics, University of Pennsylvania.

## SECTION MEETINGS

### SECTION OF DERMATOLOGY AND SYPHILOLOGY—May 1

I. EXECUTIVE SESSION—Election of Section officers and member of Advisory Committee: For Chairman, Ray H. Rulison; For Secretary, E. William Abramowitz; For member of Advisory Committee, Fred Wise.

II. PRESENTATION OF CASES FROM VARIOUS HOSPITALS.

III. DISCUSSION OF SELECTED CASES.

### SECTION OF SURGERY—May 4

I. EXECUTIVE SESSION—a. Reading of the Minutes; b. Election of Section officers and member of Advisory Committee: For Chairman, Guilford S. Dudley; For Secretary, Condict W. Cutler, Jr.; For member of Advisory Committee, Ralph Colp.

II. PRESENTATION OF CASES—a. 1. Complete removal of the lower eye-lid for epithelioma. One year result; 2. Sarcoma of the hand following irradiation for a benign lesion, Benjamin Rice Shore; b. 1. Recurrent epithelioma of ala and floor of nose and of cheek following radium treatment. Five year result; 2. Re-implantation of ureter into renal pelvis for hydronephrosis; 3. Excision of massive congenital fibromatous pigmented mole of scalp; 4. Cannon shot wound of leg. Pedicle flap graft from opposite thigh, Herbert Willy Meyer.

III. PAPERS OF THE EVENING—a. The management of the urological complications in injuries to the spine, John F. Connors; b. Cystic disease of the breast, Percy Klingenstein.

IV. GENERAL DISCUSSION—Frank E. Adair, Edwin Beer.

### JOINT MEETING—SECTION OF NEUROLOGY AND PSYCHIATRY and THE NEW YORK NEUROLOGICAL SOCIETY—May 8

I. EXECUTIVE SESSION—a. Reading of the Minutes; b. Election of Section officers and members of Advisory Committee: For Chairman, C. Burns Craig; For Secretary, Leon H. Cornwall; For members of Advisory Committee, Irving Pardee, two years (to fill the unexpired term of Leon H. Cornwall, resigned); Clarence P. Oberndorf, five years.

II. PAPERS OF THE EVENING—a. Brain abscess; two recoveries in which the Mosher drain was used, Abraham Kaplan (by invitation); Discussion: Joseph King; b. Multiple sclerosis; brief presentations of patients on quinine therapy, Richard M. Brickner; Discussion: George H. Hyslop; c. Syndrome of tonic pupils and absent reflexes, Walter Bromberg (by invitation); Discussion: Harold Wolff (by invitation); d. Disturbances in Gestalt function in psychoses and organic brain diseases, Lauretta Bender (by invitation); Discussion: Max Wertheimer (by invitation), David M. Levy.

### SECTION OF HISTORICAL AND CULTURAL MEDICINE—May 9

I. EXECUTIVE SESSION—a. Reading of the Minutes; b. Election of Officers and two members of Advisory Committee: For Chairman, Russell L. Cecil; For Secretary, Jerome P. Webster; For members of Advisory Committee, Robert H. Halsey, one year (to fill the unexpired term of Ira O. Tracy, deceased); Eugene F. DuBois, five years.

II. PAPERS OF THE EVENING—a. Historical points of interest on the mode of action and ill effects of mercury, E. William Abramowitz; b. Early 19th century dermatology and the Brothers Mahon, Theodore Rosenthal; c. Horace Wells and the discovery of anaesthetics, Walter R. Steiner, Hartford.

III. GENERAL DISCUSSION.

SECTION OF PEDIATRICS—May 10

Case Demonstrations from 7:45 to 8:45—General Discussion 8:45

I. EXECUTIVE SESSION—Election of Officers and member of Advisory Committee: For Chairman, Harry Bakwin; For Secretary, Alexander T. Martin; For member of Advisory Committee, Martha Wollstein.

II. SINGLE CASE PRESENTATION WILL BE GIVEN BY THE FOLLOWING HOSPITALS: Mt. Sinai Hospital, Amyloidosis in a child of 8 years, Presented by J. Brem; Babies' Hospital, Sequestration of right upper lobe in the course of empyema, Presented by F. W. Solley; New York Hospital, A case of rat bite fever, Presented by W. S. Anderson; Polyclinic Hospital, General miliary tuberculosis in an infant of three months, Presented by W. Morgan Hartshorn; St. Vincent's Hospital, Schistosomiasis, Presented by Hugh Leahy; Lenox Hill Hospital, Pick's syndrome in a child of 12 years, Presented by J. L. Rothstein; St. Luke's Hospital, Amyotonia, Presented by Herbert F. Jackson; Hospital for Joint Diseases, Erythema nodosum—a link in a rheumatic syndrome, Presented by Irving Claman; Israel Zion Hospital, Thrombosis of the splenic vein, Presented by Harry M. Greenwald; Beth Israel Hospital, A case of rheumatic encephalitis (chorea insanias), Presented by Irving A. Frisch; Bellevue Hospital, Leukemia with extensive bone changes, simulating rheumatic fever, Presented by Lucy Porter Sutton.

JOINT MEETING—SECTION OF MEDICINE and SECTION OF ORTHOPEDIC SURGERY—May 15

(*Members of the Section of Orthopedic Surgery please note the change of date.*)

I. EXECUTIVE SESSION—Reading of the minutes, Election of the Section Officers and members of the Advisory Committee. Section of Medicine: For Chairman, Randolph West; For Secretary, Paul Reznikoff; For member of Advisory Committee, Peter Irving. Section of Orthopedic Surgery: For Chairman, Leo Mayer; For Secretary, Walker Swift; For member of Advisory Committee, Paul C. Colonna.

II. PAPERS OF THE EVENING—SYMPOSIUM ON ARTHRITIS—a. From the medical standpoint; 1. Clinical aspects of acute arthritis, Walter L. Niles; 2. Laboratory aids in the differential diagnosis of acute arthritic conditions, Wendell J. Stainsby; 3. A medical viewpoint of acute arthritis, Ralph Boots; b. From the orthopedic standpoint; 1. The treatment of acute arthritis (surgical aspects), Allan DeF. Smith; 2. The operative treatment of chronic arthritis, Arthur Krida; 3. The non-operative treatment of chronic arthritis, Samuel Kleinberg.

III. GENERAL DISCUSSION—Harlow Brooks, Percy W. Roberts, Philip D. Willow.

SECTION OF OTOLARYNGOLOGY—May 16

I. READING OF THE MINUTES.

II. EXECUTIVE SESSION—Election of Section Officers and one member of Advisory Committee: For Chairman, Marvin F. Jones; For Secretary, Wallace Morrison; For member of Advisory Committee, Samuel J. Kopetzky.

III. CASE PRESENTATION—A pseudo-voice, probably esophageal, following total laryngectomy, Wallace Morrison; Discussion: S. Fineman, W. W. Carter, M. J. Myerson.

IV. PAPERS OF THE EVENING—a. The treatment of old and recent fractures of the nose, Gerard H. Cox (by invitation); Discussion: Jay D. Whitham (by invitation), W. W. Carter; b. Report on the anatomical study of two hundred petrous portions of the temporal bone, Mervin C. Myerson, Herman Rubin (by invitation), Joseph G. Gilbert (by invitation); Discussion opened by: Ralph Almour; c. The historical development of the surgical treatment of post-otitic brain abscess, Leo M. Davidoff; Discussion opened by: Charles A. Elsberg, Joseph E. J. King; d. Adenoma of the bronchial mucous glands (lantern slides), B. M. Fried (by invitation).

V. GENERAL DISCUSSION.

SECTION OF OPHTHALMOLOGY—May 21

I. INSTRUCTION HOUR, 7 to 8 o'clock—Demonstration of the stereoscopic treatment of heterophoria, David W. Wells (by invitation).

II. DEMONSTRATION HOUR, 7:30 to 8:30 o'clock—a. Slit lamp studies; b. Demonstration of anatomical specimens with slit lamp, Manuel U. Troncoso (by invitation); c. Case demonstrations.

III. SECTION MEETING, 8:30 to 10:30 o'clock—a. Executive session; 1. Reading of the minutes; 2. Election of Section Officers and member of Advisory Committee: For Chairman, Webb W. Weeks; For Secretary, W. Guernsey Frey, Jr.; For member of Advisory Committee, Bernard Samuels; b. Case reports; 1. A case of sympathetic ophthalmia, Frank C. Keil; 2. Surgical approach of the levator through the skin, Daniel B. Kirby, L. Connor Moss (by invitation). Case 1. Ptosis, Case 2. Exophthalmos; 3. Melanoma of the conjunctiva—fatal termination, James W. Smith; Scientific papers; 1. Meningiomas of the sphenoid ridge, Charles A. Elsberg; Discussers: John M. Wheeler, Joseph E. King, Thomas H. Johnson, Cornelius Dyke (by invitation); 2. Cyclopia, Howard B. Adelmann (by invitation); Discusser: Charles R. Stockard.

SECTION OF OBSTETRICS AND GYNECOLOGY—May 22

I. EXECUTIVE SESSION—a. Reading of the minutes; b. Election of Section Officers and member of Advisory Committee: For Chairman, Harvey B. Matthews; For Secretary, Walter B. Mount; For member of Advisory Committee, David N. Barrows.

II. PRESENTATION OF NEW INSTRUMENTS—A new catheter apparatus, Morris Leff; Discussion: Harbeck Halsted.

III. PAPERS OF THE EVENING—a. The production of active endometrium in the human castrate, Theodore Neustaedter; Discussion: Robert T. Frank; b. The Robert's modification of the Pfannenstiel incision, Kingsley Roberts, Leon Loizeaux; Discussion: A. J. Bullard, W. T. Kennedy, Harbeck Halsted, Max D. Mayer, D. W. Tovey; c. The barbiturates in primiparous labors, John T. Tritsch (by invitation); Discussion, Harbeck Halsted, S. J. Scadron, Leon Loizeaux, G. L. Bowen; d. The pelvic outlet—its importance in obstetrics, Joshua W. Davies (by invitation); Discussion: W. T. Kennedy.

NEW YORK MEETING OF THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE UNDER THE AUSPICES OF THE NEW YORK ACADEMY OF MEDICINE—May 16

I. Nervous control of thyroid activity; II. Effect of thyreoactivator in absence of central nervous system, E. Uhlenhuth.

II. Effect of Antuitrin "S" vitamine on reproduction in rabbit, P. D. Rosahn, H. S. N. Greene, C. K. Hu.

III. Observations on fowl paralysis (neurolymphomatosis), J. Furth.

IV. Local cerebral anaphylaxis in the dog, L. M. Davidoff, N. Kopeloff.

V. Hemorrhages in skin lesions after intravenous injection of starch, J. Freund, W. F. Smith, Jr.

VI. Action of sodium salicylate on fermentation of salicin and glucose by streptococci, E. Valentine, L. Reiner.

VII. Antistreptolysin content of blood serum of children. Its significance in rheumatic fever, M. G. Wilson, C. W. Wheeler, M. M. Leask (Introduced by O. M. Schloss).

VIII. Electrocardiographic evidence of cardiac involvement in acute disease, A. M. Master, H. Jaffe.

## AFFILIATED SOCIETIES

NEW YORK ROENTGEN SOCIETY (IN AFFILIATION WITH THE NEW YORK ACADEMY OF MEDICINE)—May 21

I. 8:00 to 8:30 p.m.—Demonstration and discussion of interesting cases.

II. 8:30 p.m.—Some observations on the roentgen diagnosis of obscure lesions in the upper gastro-intestinal tract, Geo. W. Holmes, Boston.

III. General Discussion.

IV. Executive Session.

NEW YORK PATHOLOGICAL SOCIETY (in affiliation with the New York Academy of Medicine)—May 24

I. Demonstration of Pathological Specimens—a. Mitral stenosis with inter-auricular insufficiency, Seaton Sailer (by invitation).

II. Papers of the Evening—a. Synoviomata: report of three cases, Leila Charlton Knox; b. Hypertension and obesity associated with malignant adenoma of the adrenal and a pituitary chromophobic adenoma, Joseph J. Bunim (by invitation), Antonio Rottino (by invitation), Irving Graef; c. Some observations on the morphology of glandular hyperplasia of the prostate, Robert A. Moore.

III. Executive Session.

SECTION OF GENITO-URINARY SURGERY

The following were elected at the April meeting of the Section: Chairman, Augustus Harris; Secretary, Joseph A. Hyams; Member of Advisory Committee, George F. Hoch.

No May meeting of this Section was held.

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## RECENT ACCESSIONS TO THE LIBRARY

American society of clinical pathologists. The medicolegal necropsy.
Balt., Williams, 1934, 167 p.

Bache, L. F. Health education in an American city.
Garden City, Doubleday, 1934, 116 p.

Ballance, (Sir) C. A. The Lister memorial lecture . . . 1933.
Dundee, Thomson, [1933], 77 p.

Billroth, C. A. T. Historical studies on the nature and treatment of gunshot wounds. . .
New Haven, Nathan Smith Med. Club, 1933, 82 p.

Chauvois, L. Circulation du sang (schéma nouveau).
Paris, Baillière, 1933, 172 p.

Clinique (La) urologique de Necker, 1912-1933.
Paris, Masson, 1933, 305 p.

Emerson, H. Alcohol, its effects on man.
N. Y., Appleton-Century, 1934, 113 p.

Fujikawa, Y. Japanese medicine.
N. Y., Hoeber, 1934, 114 p.

Gutman, J. Modern drug encyclopedia and therapeutic guide.
N. Y., Hoeber, 1934, 1393 p.

Haggard, H. W. Mystery, magic, and medicine.
Garden City, Doubleday, 1933, 192 p.

Harrow, B. & Sherwin, C. P. The chemistry of the hormones.
Balt., Williams, 1934, 227 p.

Heidel, W. A. The heroic age of science.
Balt., Williams, 1933, 203 p.

Heitzmann, L. Urinary analysis and diagnosis. 6. ed.
Balt., Wood, 1934, 385 p.

Iyer, T. G. R. The hand book of Indian medicine.
Fort, Erode, Sri Vani Vilas Press, 1933, 540 p.

Jeanselme, E. Le lèpre.
Paris, Doin, 1934, 679 p.

Jennings, H. S. The universe and life.
New Haven, Yale Univ. Press, [1934], 94 p.

Kerney, E. A glossary of French medical terms referable to the eye.
N. Y., Institute of French Studies, 1934, 209 p.

Killian, H. Facies dolorosa.
Leipzig, Thieme, 1934, 88 p.

McIver, M. A. Acute intestinal obstruction.
N. Y., Hoeber, 1934, 430 p.

Merry, R. V. Problems in the education of visually handicapped children.
Cambridge, Harvard Univ. Press, 1933, 243 p.

Naegeli, O. Allgemeine Konstitutionslehre. 2. Aufl.
Berlin, Springer, 1934, 190 p.

Olivecrona, A. H. Die parasagittalen Meningeome.
Leipzig, Thieme, 1934, 143 p.

Ormsby, O. S. A practical treatise on diseases of the skin. 4. ed.
Phil., Lea, 1934, 1288 p.

Parsons, T. R. Fundamentals of biochemistry. 4. ed.
Cambridge, Eng., Heffer, 1933, 435 p.

Penrose, L. S. The influence of heredity on disease.
London, Lewis, 1934, 80 p.

Principles and practice of physical therapy, edited by H. E. Mock, R. Pemberton, J. S. Coulter.
Hagerstown, Prior, 1934, 3 v.

Rathbone, J. L. Corrective physical education.
Phil., Saunders, 1934, 292 p.

Reid, W. D. Teaching methods in medicine.
[Boston, author, 1933], 111 p.

Roffo, A. H. & Thomas, J. La chimie du cancer.
Paris, Vigot, 1933, 339 p.

Salmon, M. & Dor, J. Les artères des muscles des membres et du tronc.
Paris, Masson, 1933, 238 p.

Schwesinger, G. C. Heredity and environment.
N. Y., Macmillan, 1933, 484 p.

Sure, B. The vitamins in health and disease.
Balt., Williams, 1933, 206 p.

Vehrs, G. R. Spinal anesthesia; technic and clinical application.
St. Louis, Mosby, 1934, 269 p.

Westhues, H. Die pathologisch-anatomischen Grundlagen der Chirurgie des Rektumkarzinoms.
Leipzig, Thieme, 1934, 113 p.

# DOCTOR WILLIAM HENRY WELCH
## 1850-1934

*An Honorary Fellow of The New York Academy of Medicine*

Doctor William H. Welch was born in Norfolk, Connecticut, on April 8, 1850, and died in the Johns Hopkins Hospital, Baltimore, on April 30, 1934. He was the outstanding figure in American medicine, and his international reputation was such as to place him in the forefront among his medical contemporaries. The range of Doctor Welch's intellectual powers was so large, and the fascination of his presence so captivating, that he may be said to have become the most revered and beloved physician of his time. No utterance of his, whether in the realm of science, literature, the arts, or history failed to arrest attention by reason of the learning and charm revealed. The encyclopedic nature of Doctor Welch's mind made it possible for him successively to fill the chairs of pathology, hygiene, and the history of medicine at Johns Hopkins University. He resigned the professorship of pathology at the age of sixty-five, only to take up the professorship of hygiene, which in turn he relinquished at seventy-five, to assume the professorship of the history of medicine. And in all these undertakings he was a pioneer, creating the opportunities and producing the means by which they could be realized. Doctor Welch may be said to have brought the modern pathology to the United States, and to have organized his laboratory with a comprehensiveness which placed it at once in advance of the best European models. Before Doctor Welch's day there was no school of hygiene in this country, and none in a fully developed state anywhere; the school which he designed and put into operation quickly became the model of the world. And before the Institute of the

A biographical sketch of Dr. Welch, by the author, is included in "Papers and Addresses," published on his 70th birthday, in 1920. It may be consulted for a fuller and more systematic account of the main incidents of Dr. Welch's professional life. The sketch was reprinted in *Science*, 1920, *52*, 417. Brief summaries are also available in "American Men of Science," 5th edition, 1933; and in "Who's Who."

History of Medicine was created by him, no such school existed outside of Germany.

Doctor Welch came from a family of physicians. His father and four of his father's brothers, his grandfather and great-grandfather were physicians. Doctor Welch entered Yale College in 1866 and was graduated in 1870, third in his class. He taught school one year, and then entered the College of Physicians and Surgeons in New York City, but only to leave and return at once to New Haven for a year of extra study in chemistry at the Sheffield Scientific School and the Yale Medical School. This early deviation from the ordinary course of events in the study of medicine must have seemed arbitrary, and yet it cannot be so regarded now. There was a kind of prescience in the act, since it showed that he appreciated well in advance of prevailing beliefs the important role which chemistry would come to play in the science and art of medicine. Doctor Welch returned to the study of medicine in 1872; and the even tenor of his progress through college was perturbed by what ordinarily would be an inconspicuous event. He won as a prize in the course in neurology a microscope fitted with superior lenses. This success had two consequences, one important, the other of passing interest. The microscope "produced the spark which ignited the tinder of a latent interest in pathology," and it led to a desire to specialize in diseases of the nervous system, which latter did not survive the German experience still a few years distant.

Following graduation, there was a not unusual period of struggle in New York, lasting two years; and then in 1876, together with his friend and fellow townsman, Doctor Frederick S. Dennis, we find Doctor Welch embarking for Europe. This is not the place in which to describe the fruitful two years of European study which followed, but it is necessary to record another significant departure from the usual course pursued by medical students. Doctor Welch offered himself to, and was accepted by the leading physiologist, Carl Ludwig, professor at the University in Leipzig. That Doctor Welch had perceived the importance of phys-

iology for the impending growth of scientific medicine is another example of the penetrating power of his intelligence. Moreover, this choice was to lead to a still greater piece of good fortune, for it directed Doctor Welch's specifically pathological studies into an unusual channel, and away from Virchow and his school, the center of interest at the time, to Cohnheim and physiological pathology, which was to provide a firmer and more immediate foundation for experimental medicine. Associated with Cohnheim were the brilliant, young investigators, Weigert and Ehrlich, soon to open new vistas in pathology. They and Doctor Welch proved congenial; and intimate, enduring friendships followed. There is always the temptation to attribute to accident these fortunate happenings in the careers of eminent men. Given Doctor Welch's endowments and the circumstance that he came under Cohnheim's influence—the result of his studies with Ludwig—the rest succeeded unavoidably, namely the rewarding relations with Weigert and Ehrlich, the early contact with Robert Koch, and most important of all, the call to the Johns Hopkins Hospital at Cohnheim's suggestion.

To pursue extra studies in chemistry as a preparation for medicine, to seek a physiological foundation for pathology, simply meant, as soon became apparent, that Doctor Welch's compulsion was to delve deeply into the springs of knowledge. This compulsion reveals itself in all phases of his subsequent career, whether he is carried into the new fields of hygiene and preventive medicine, into historical studies, or into the cultivation of literature or the arts, the beginnings of which are lost in the remote days of his early youth. A mind thus constituted does not stop abruptly at a given boundary. Those intimates of Doctor Welch who were privileged to pass beyond the barrier of his unusually modest reticence, soon discovered that his knowledge of belles-lettres, poetry, music and the other arts, rivalled that of medical science and lore. There resulted from this happy concatenation of forces a remarkably rounded and complete personality, in which no one highly specialized interest absorbed all the available powers to the

exclusion of other and diverse, momentous interests to which the human spirit might respond.

Doctor Welch returned to New York in 1878, the future uncertain, and the next half dozen years were spent in a medley of activities: Goldthwaite's quiz, pathology at Bellevue Hospital and Bellevue Medical College, practice, association with the elder Flint then engaged on his "Practice of Medicine" to which Doctor Welch contributed the chapters on general and special pathology, constituting virtually a treatise on the subject which even today possesses intrinsic as well as historical interest.

The appointment to the professorship of pathology at the Johns Hopkins University was made in 1884. Thus it came about that in April, 1934, Doctor Welch's eighty-fourth birthday and the fiftieth anniversary of his residence in Baltimore could be celebrated jointly. Messages of affection and admiration came from near and far; and Doctor Welch was hailed not only as leader in medicine, but as first citizen of Maryland.

In 1884, the Johns Hopkins Hospital was still incomplete and the Johns Hopkins Medical School still merely an aspiration which was to be realized ten years later. The new bacteriology had just been brought into being by Koch and his early, gifted pupils; hence Doctor Welch returned to Germany to acquire the technique of this new branch of learning destined soon to open a new and brilliant era in medical progress. There repaired to Germany also at this time, Doctor T. Mitchell Prudden, whose career in pathology in New York was second only in importance to that of Doctor Welch in Baltimore. These fellow students at Yale, fellow pathologists in New York, were to meet again in Koch's laboratory in Berlin, and to renew and strengthen ties of mutual purpose and friendship which were to unite them in many subsequent undertakings of a philanthropic and professional nature.

Although Doctor Welch remained all his life a cosmopolitan in education, yet it was the long Baltimore period of his activities which established his fame and made him

the statesman and prophet of modern medicine in the United States. He brought together the first faculty of the Johns Hopkins Hospital and Johns Hopkins Medical School, he guided the events which placed the Johns Hopkins Medical School at its inception on a high level of teaching, scholarship, and research; hence he, more than anyone else, was responsible for the amazing advances made in medical education in the United States during the past forty years.

During the pregnant half century of Doctor Welch's Baltimore professorates, his extraordinary energies had scarcely abated until the onset of his last illness. Thus he continued active mentally and physically almost until the end; and throughout these five decades he was distinguished as the brilliant teacher, successful investigator, broad scholar, charming companion, and wise counselor. No one was called on more than he to advise in important educational and philanthropic enterprises; to these appeals Doctor Welch gave his time without stint. Doctor Welch's printed papers and addresses collected and published on his seventieth birthday make three noble volumes. They are a treasure house of knowledge and wisdom, and they cover an altogether extraordinarily broad expanse of learning.

And no one was endowed with a warmer heart than Doctor Welch, who appeared gifted with the secret of perpetual youth, for his wide interests never waned, and he formed deep and affectionate friendships with succeeding groups of younger men. In short, Doctor Welch may be said to have warmed both hands at the genial flame of life, and to have been inspiration, guide, joy, and delight to many men.

SIMON FLEXNER.

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## DEATH OF FELLOW

DOTY, ALVAH HUNT, M.D., 110 Monterey Avenue, Pelham, N. Y.; graduated in medicine from Bellevue Hospital Medical College in 1878; elected a Fellow of the Academy March 5, 1891; died May 27, 1934. Dr. Doty was a member of the State and County Medical Societies, the American Medical Association, and the American Public Health Association. Dr. Doty was health officer of the Port of New York from 1895 to 1912.